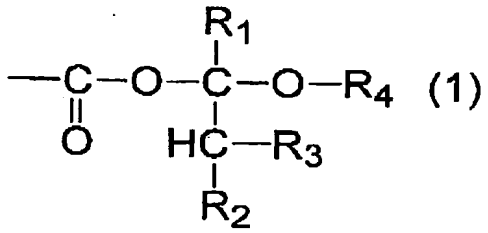
CLAIMS

1. An underlayer coating forming composition for lithography comprising a compound having a protected carboxyl group of formula (1):



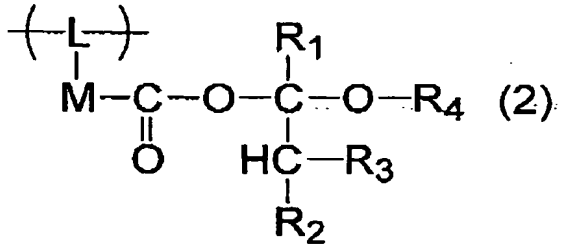
(1)

wherein R_1, R_2 and R_3 are independently of one another, hydrogen atom or C_{1-10}alkyl group, R_4 is C_{1-10}alkyl group, or R_3 and R_4 together may form a ring, a compound having a group capable of reacting with a carboxyl group, and a solvent.

2. An underlayer coating forming composition for lithography comprising a compound having a group capable of reacting with a carboxyl group, and a protected carboxyl group of formula (1) wherein R_1, R_2, R_3 and R_4 have the same meaning as that defined in claim 1, and a solvent.

3. The underlayer coating forming composition for lithography according to claim 1 or 2, wherein the group capable of reacting with a carboxyl group is a group selected from the group consisting of an epoxy group, an oxetanyl group, an oxazoline group, a cyclocarbonate group, an alkoxysilyl group, an aminomethylol group, an aziridinyl group, a methylol group, a hydroxy group, an isocyanate group, an alkoxymethylamino group, and a hydroxysilyl group.

4. The underlayer coating forming composition for lithography according to claim 1, wherein the compound having the protected carboxyl group of formula (1) is a polymer containing a unit structure of formula (2):

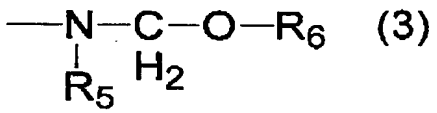


(2)

wherein L is a bonding group constituting a main chain of the polymer, and M is a direct bond or a linking group.

5. The underlayer coating forming composition for lithography according to claim 1, wherein the compound having a protected carboxyl group of formula (1) is a compound having at least two protected carboxyl groups of formula (1) and a molecular weight of 200 to 2000.

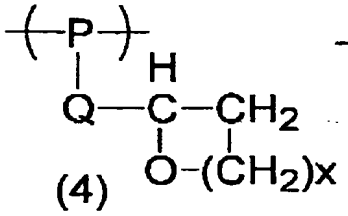
6. The underlayer coating forming composition for lithography according to claim 1, wherein the compound having a group capable of reacting with a carboxyl group is a compound having at least two groups of formula (3):



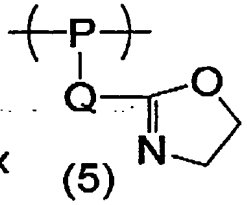
(3)

wherein R_5 is hydrogen atom, C_{1-6}alkyl group or $-CH_2OR_7$ wherein R_7 is hydrogen atom or C_{1-10}alkyl group, and R_6 is hydrogen atom or C_{1-10}alkyl group.

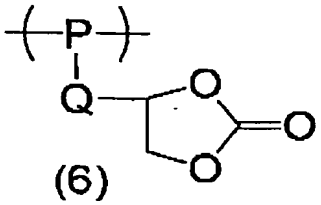
7. The underlayer coating forming composition for lithography according to claim 1, wherein the compound having a group capable of reacting with a carboxyl group is a polymer containing at least one unit structure selected from the group consisting of formulae (4), (5), (6), (7), (8) and (9):



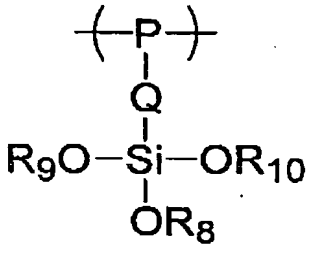
(4)



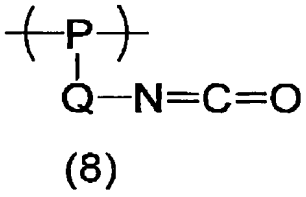
(5)



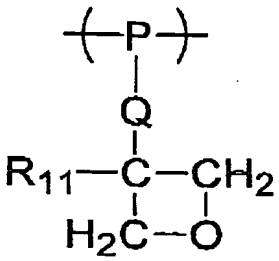
(6)



(7)



(8)

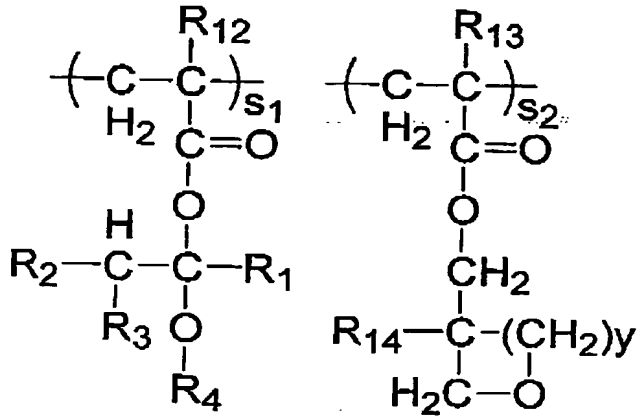


(9)

wherein P is a bonding group constituting a main chain of the polymer, Q is a direct bond or a linking group, R_8, R_9, R_{10} and R_{11} are independently of one another, hydrogen atom or C_{1-5}alkyl group, and x is 0 or 1.

8. The underlayer coating forming composition for lithography according to claim 2, wherein the compound having a group capable of reacting with a carboxyl group, and a protected carboxyl group of formula (1) is a polymer containing the unit structure of formula (2) and at least one unit structure selected from the group consisting of formulae (4), (5), (6), (7), (8) and (9).

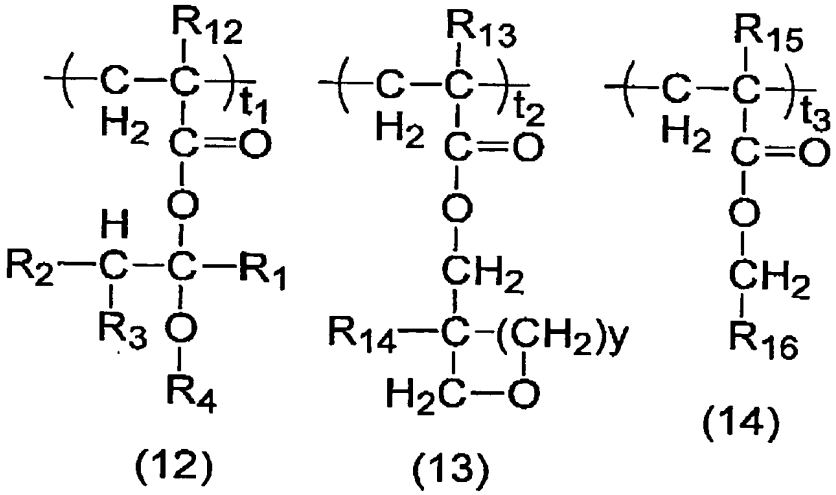
9. The underlayer coating forming composition for lithography according to claim 2, wherein the compound having a group capable of reacting with a carboxyl group, and a protected carboxyl group of formula (1) is a polymer containing the unit structure of formulae (10) and (11):



(10) (11)

wherein R_{12} and R_{13} are independently of each other hydrogen atom or methyl group, R_{14} is hydrogen atom, methyl group or ethyl group, y is 0 or 1, s_1 and s_2 are molar ratio of each unit structure constituting the polymer, s_1 is 0.05 to 0.95 and s_2 is 0.05 to 0.95, with proviso that $0.1 \leqq s_1 + s_2 \leqq 1$.

10. The underlayer coating forming composition for lithography according to claim 2, wherein the compound having a group capable of reacting with a carboxyl group, and a protected carboxyl group of formula (1) is a polymer containing the unit structure of formulae (12), (13) and (14):



(12) (13) (14)

wherein R_{12}, R_{13} and R_{14} have the same meaning as that defined in claim 9, R_{15} is hydrogen atom or methyl group, R_{16} is hydrogen atom, C_{1-6}alkyl group, phenyl group, naphthyl group or anthryl group, t_1, t_2 and t_3 are molar ratio of each unit structure constituting the polymer, t_1 is 0.05 to 0.90, t_2 is 0.05 to 0.90 and t_3 is 0.05 to 0.90, with proviso that $0.15 \leqq t_1 + t_2 + t_3 \leqq 1$.

11. The underlayer coating forming composition for lithography according to any one of claims 1 to 10, further comprising a light absorbing compound.

12. A method for forming an underlayer coating for use in manufacture of semiconductor device, comprising coating the underlayer coating forming composition for lithography according to any one of claims 1 to 11 on a semiconductor substrate and baking it.

13. An underlayer coating obtained by coating the underlayer coating forming composition for lithography according to any one of claims 1 to 11 on a semiconductor substrate and baking it.

14. A method for forming photoresist pattern for use in manufacture of semiconductor device, comprising coating the underlayer coating forming composition for lithography according to any one of claims 1 to 11 on a semiconductor substrate, and baking it to form an underlayer coating, forming a photoresist layer on the underlayer coating, exposing the semiconductor substrate covered with the underlayer coating and the photoresist layer to light, and developing the photoresist layer after the exposure to light.

15. The method for forming photoresist pattern according to claim 14, wherein the exposure to light is carried out with a light of a wavelength of 248 nm, 193 nm or 157 nm.